

Strategies to Minimize Phosphorus Loss From Your Farm

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This guide discusses steps you can take to reduce phosphorus loss from your farm. See *Nutrients and Water Quality of Lakes and Streams* (G9221), and *Agricultural Phosphorus and Water Quality* (G9181) for more information on how phosphorus lost from agricultural fields affects water quality.

The primary way phosphorus leaves a field is through water passing over the surface of the soil as runoff.

- Soil particles eroded by surface water runoff can carry large amounts of phosphorus.
- Runoff water passing over the soil surface also picks up “dissolved” or “soluble” phosphorus.

Phosphorus loss from a field in runoff requires two things happen at the same time:

1. A source of phosphorus needs to be on the soil surface in a form that can move off the field.
2. A rainfall or snowmelt event needs to generate runoff from the field.

Most strategies to reduce phosphorus minimize the amount of phosphorus that is available on the soil surface when, inevitably, runoff occurs.

Follow these recommendations to reduce phosphorus loss from your farm:

- Apply phosphorus to fields that have an agronomic need for phosphorus. Phosphorus applied to low-testing fields will increase yields. Better plant productivity may lead to less erosion and runoff.
- Use the phosphorus index to identify fields that have a high potential for phosphorus loss.
- Use crop selection and soil conservation practices to reduce the amount of runoff and erosion from agricultural fields.
- Maintain buffer strips around water resources. Setback areas filter out soluble phosphorus and eroded soil particles before they reach streams or lakes.

The amount of phosphorus lost through runoff is typically small in relation to the amount that is added as fertilizer. Surface water resources receiving runoff are highly sensitive, so even small amounts of phosphorus lost from each acre in a watershed combine to have a large effect on water quality.

- Apply phosphorus sources below the surface in tilled systems. This helps only if phosphorus incorporation does not significantly increase erosion.
- Surface-apply phosphorus sources during periods of the year when runoff is unlikely. Runoff is most likely to occur in spring when soils are often saturated with water and rainfall events are most frequent.
- Do not surface-apply phosphorus sources to frozen, snow-covered or saturated soils. Applying manure under these conditions is illegal under water quality regulations.

Does phosphorus leach through the soil?

Water infiltrating into the soil can also carry nutrients. Phosphorus loss by this pathway is limited because the soil acts as a filter, stripping phosphorus from water that passes through the soil.

Leaching of phosphorus through the soil is most likely to be a problem on soils with extremely high soil test phosphorus levels that extend far below the surface of the soil. Phosphorus losses to ground water can also occur where percolating water bypasses the soil matrix by moving through soil cracks. A shallow water table or tile drainage can further increase the potential for leaching phosphorus through the soil. This guide focuses on reducing phosphorus losses in runoff because these losses typically are much more of a problem on most Missouri farms.

The best strategy to minimize phosphorus leaching is to prevent overloading of the soil with phosphorus that leads to saturating the subsoil with phosphorus.

Erosion control reduces phosphorus loss

Erosion occurs when runoff water carries soil particles from a field. Erosion selectively moves the smaller soil particles that typically have the highest phosphorus content.

Erosion control can be the most effective means to reduce phosphorus loss from a field, particularly when erosion rates exceed sustainable rates (the soil's "T" value (tolerable soil loss value)). Erosion control often plays a large role in phosphorus control, particularly on tilled fields and fields in row-crop production. Erosion control is particularly important on fields where phosphorus levels in the surface soil are elevated well above what is needed for crop production.

To control erosion, work with your local Natural Resources Conservation Service (NRCS) office to develop a conservation plan for your farm.

Soluble losses in phosphorus

Runoff water passing over a field always contains some soluble phosphorus. The higher soil test phosphorus is in the surface soil, the higher the concentration of soluble phosphorus will be in runoff from a field.

Manure and other phosphorus-containing fertilizers include large amounts of soluble phosphorus. If you have a runoff event soon after a surface-application of one of these materials, the runoff will contain high concentrations of soluble phosphorus. Field research has documented fertilizer applications increasing soluble phosphorus concentrations over 100 times background levels.

In the days after surface application of phosphorus fertilizers, the applied materials react with the soil, dramatically reducing the soluble phosphorus available for loss in runoff.

High soil test levels increase phosphorus levels in runoff, but these changes are dwarfed by the potential losses associated with a poorly timed fertilizer or manure application.

Managing phosphorus losses in pasture

Animal activities and management create areas in pastures prone to phosphorus loss.

Animals tend to congregate near water sources, shade trees and winter feeding areas. Consequently,

Good or Bad?

Q and A on reducing phosphorus loss

Q. A farmer applies manure to a pasture with very low soil test phosphorus. Good or bad?

A. Good! Improved pasture quality will reduce erosion and runoff more than offsetting any increase in soluble phosphorus concentrations in runoff due to higher soil test levels.

Q. A pasture has extremely high soil test levels on the soil surface. A farmer is considering tilling the pasture to reduce surface soil test phosphorus levels. Good or bad?

A. Bad! Any benefit from reduced phosphorus levels on the surface of the soil will be offset by the potential for excessive erosion from the tilled field.

Q. A farmer has been applying two year's worth of phosphorus in a single application. To improve water quality he plans to apply half as much in an application but apply phosphorus every year. Good or bad?

A. Bad! There is no water quality benefit from splitting the phosphorus applications into two trips across the field. Splitting phosphorus applications will increase the cost of fertilizer management.

these areas tend to have higher soil test phosphorus levels and more manure on the soil surface than other parts of the pasture. Maintain setbacks between these areas and water resources. Consider shifting winter feeding areas over time to distribute the nutrient benefits of these areas.

Manure on the surface of a pasture in winter and spring contains significant amounts of soluble phosphorus during a time when runoff is likely. Place animals in pastures where runoff is unlikely to reach sensitive waters during late winter and spring.

Keep animals out of streams and ponds. A single defecation by a cow in a stream can equal the phosphorus loss from a one-acre field during an entire year. Overgrazing along streams can also lead to excessive erosion initiated by hoof damage to stream banks.

Also from MU Extension Publications

G9181 *Agricultural Phosphorus and Water Quality*

G9182 *Managing Manure Phosphorus to Protect Water Quality*

G9218 *Managing Nitrogen to Protect Water Quality*

G9221 *Nutrients and Water Quality for Lakes and Streams*